

MONTHLY WEATHER REVIEW.

Editor : Prof. CLEVELAND ABBE. Assistant Editor : H. H. KIMBALL.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for June, 1903, is based on data from about 3300 stations, classified as follows:

Weather Bureau stations, regular, telegraph and mail, 160; West Indian Service, cable and mail, 8; River and Flood service, 52, river and rainfall, 177, rainfall only, 62; voluntary observers, domestic and foreign, 2565; total Weather Bureau Service, 2962; Canadian Meteorological Service, by telegraph and mail, 20, by mail only, 13; Meteorological Service of the Azores, by cable, 2; Meteorological Office, London, by cable, 8; Mexican Telegraph Company, by cable, 3; Army Post Hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Company, 96; Hawaiian Meteorological Service, 75; Jamaica Weather Service, 130; Costa Rican Meteorological Service, 25; The New Panama Canal Company, 5; Central Meteorological Observatory of Mexico, 20 station summaries, also printed daily bulletins and charts, based on simultaneous observations at about 40 stations; Mexican Federal Telegraph Service, printed daily charts, based on about 30 stations.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Territorial Meteorologist, Honolulu, H. I.; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander W. H. H. Southerland, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San José,

Costa Rica; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. M. Shaw, Esq., Secretary, Meteorological Office, London; Rev. Josef Algué, S. J., Director, Philippine Weather Service; and H. H. Cousins, Chemist, in charge of the Jamaica Weather Office.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is $157^{\circ} 30'$, or $10^{\text{h}} 30^{\text{m}}$ west of Greenwich. The Costa Rican standard of time is that of San José, $0^{\text{h}} 36^{\text{m}} 13^{\text{s}}$ slower than seventy-fifth meridian time, corresponding to $5^{\text{h}} 36^{\text{m}}$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

The month of June, 1903, had a remarkable record for loss of life and property by flood and storms throughout the United States.

In the lower Missouri and upper Mississippi rivers lives were lost and property to the value of millions of dollars was destroyed by floods that were second in magnitude only to the floods of June, 1844.

At St. Louis, Mo., the Mississippi River passed the danger line, 30 feet, on the 2d, and reached a stage of 38 feet on the 10th. The various stages at that point were accurately forecast for from two to four days in advance.

A full description of the floods referred to, the damage they caused, and the action taken by the Weather Bureau in issuing warnings in connection therewith, will be found under the heading "Rivers and floods."

During the early days of the month heavy rains caused freshets in the east Gulf and South Atlantic States, and at points in Arkansas the Arkansas River was from 1 to 2 feet above the danger line. In the north Pacific coast States high temperatures and a great amount of snow in the mountains furnished conditions favorable for rises in the Columbia River and tributaries.

On the 6th Pacolet, Clifton, and Glendale, S. C., were devastated by floods due to heavy rains in the mountainous watersheds of the streams of that district. Many lives were lost in and about the places named, and the property loss has been

estimated at about \$3,000,000. During the 7th and 8th the James River, Virginia, rose rapidly. On the 12th flood conditions were reported in the Delaware River at Port Jervis, N. Y., and in the Raritan Valley, New Jersey.

On the 14th torrential rains in a range of hills south of Heppner, Oreg., caused a rush of water down the bed of Willow Creek, in which the town is located, drowning about 200 persons and destroying property to the estimated value of \$250,000.

High water, due to melting snow in the upper headwaters of the Rio Grande River and heavy rain in northern New Mexico, was reported in the Rio Grande River, in New Mexico, and western Texas on the 14th and 15th. On the 18th the Rio Grande reached a maximum stage at San Marcial, N. Mex., where the water was several feet deep in the lower portion of the town.

On the 28th and 29th heavy rains fell in localities in the Middle Atlantic States.

A period of rainy weather that set in on the 7th and continued intermittently during the balance of the month broke a drought that had prevailed in the Middle Atlantic and New England States for nearly two months, and extinguished destructive forest fires that were raging in the Catskills, Adirondacks, and White mountains.

On the 1st a tornadic storm struck Gainesville, Ga., killing or fatally injuring more than 100 persons, and destroying property to the value of about \$500,000.

A period of warm weather set in over California, Nevada, and the north Pacific coast States on the 5th and continued until the 8th, with maximum temperatures above 100° in the central valleys of California on the 6th, 7th, and 8th, and maximum temperatures ranging from 95° to 97° in western Oregon and western Washington on the 7th and 8th.

Frost was reported in the western parts of North Dakota and South Dakota on the 10th, in parts of Minnesota, South Dakota, Nebraska, western Kansas, and northern Iowa on the 11th, and in Michigan and parts of Wisconsin and Iowa on the 12th.

In the south of England the middle part of the month was wet and unseasonably cold, while in the north of England the country was suffering from drought.

On the North Atlantic Ocean and on the coasts and Great Lakes of the United States the storms of the month were not severe.

BOSTON FORECAST DISTRICT.

The month was characterized by much cloudiness, uniformly low temperature, excessive rainfall, and an unusual prevalence of easterly winds and fog. Storm warnings were displayed on the 12th, 13th, 15th, 16th, 20th, 22d, and 23d. No storms or dangerous winds occurred for which warnings were not issued.—*J. W. Smith, District Forecaster.*

NEW ORLEANS FORECAST DISTRICT.

The month was unseasonably cool, and at New Orleans it was the coolest June on record. No severe storms occurred on the west Gulf coast. To supply demands for information regarding the effect, in the lower Mississippi Valley, of the high water in the upper Mississippi and lower Missouri rivers during the early part of the month, the following statement was issued on the 11th:

The Mississippi, below Vicksburg, and the Atchafalaya, will rise slowly for three weeks and possibly longer, and the danger line, 16 feet, will probably be reached at New Orleans within ten days or two weeks.

The river rose slowly from 13.6 feet on June 11 to 15.4 feet on July 2, 1903.—*I. W. Cline, District Forecaster.*

CHICAGO FORECAST DISTRICT.

There was no storm of consequence on the upper Lakes during the month, and no warnings were issued.

Unusually cool weather prevailed over the districts until near the end of the month.—*H. J. Cox, Professor of Meteorology.*

DENVER FORECAST DISTRICT.

The feature of the month was the copious precipitation that occurred on the southeastern watersheds during the first two weeks.

High stages were reached in the Arkansas River, principally as a result of the heavy rainfall on the drainage areas of its southern tributaries, while in the case of the Rio Grande the usually high stages were due to the melting of snow on its upper watersheds in Colorado, in conjunction with continued rainfall in northern New Mexico, which was forecast from day to day during the period.—*J. H. Brandenburg, District Forecaster.*

SAN FRANCISCO FORECAST DISTRICT.

On the 3d the temperature began to rise in northern California and on the 4th in Nevada; developing into a warm wave

on the 5th, which continued over Nevada until the 8th and northern California until the 9th. Temperatures exceeding 100° were general in the great valleys of California on the 6th, 7th, and 8th. On the coast exceptionally high temperatures for the season occurred on the 6th.—*G. H. Willson, Local Forecaster, temporarily in charge.*

PORTLAND, OREG., FORECAST DISTRICT.

During the afternoon of June 14 a severe thunderstorm, with heavy rain and hail, occurred near the foot of the Blue Mountains in the southern part of Morrow County, Oregon. Owing to the nonabsorbant condition of the soil and the steepness of the catchment area, this rain quickly collected in the canyon near the head of Willow Creek and formed a flood which swept down the valley and wrought great destruction. The town of Heppner, near the starting point of the rushing waters, suffered the loss of nearly 200 of its inhabitants and, as near as can be estimated, property damaged to the extent of \$250,000. At the beginning the flood crest was coincident with the first appearance of the flood, but as the water advanced and spread over a large area the crest lagged several hours behind the beginning of the rise. The annual rise in the Columbia River made its appearance later than usual, and the danger line at Portland was not reached until the evening of the 3d. Daily forecasts of expected heights in the river were issued during the month for periods of a week in advance; they proved to be very accurate, and in the precautions that were taken rendered the damage to property by flood very light.—*E. A. Beals, District Forecaster.*

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocity.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.										
I.....	3, p.m.	41	124	5, a.m.	47	117	1,025	1.5	683	28.4
II.....	8, a.m.	54	114	14, a.m.	35	90	2,450	6.0	408	17.0
III.....	15, a.m.	53	108	19, a.m.	47	65	3,000	4.0	750	31.2
IV.....	19, p.m.	41	124	22, a.m.	42	101	1,700	2.5	680	28.3
Sums.....							8,175	14.0	2,521	104.9
Mean of 4 paths.....							2,044		630	26.2
Mean of 14.0 days.....									584	24.3
Low areas.										
I.....	1, a.m.	40	122	2, p.m.	41	112	775	1.5	517	21.5
II.....	6, p.m.	50	97	9, p.m.	46	78	1,000	3.0	333	13.9
III.....	8, p.m.	32	91	16, a.m.	32	65	3,250	7.5	433	18.0
IV.....	12, p.m.	41	117	16, p.m.	45	80	2,225	4.0	556	23.2
V.....	16, p.m.	51	120	21, p.m.	42	70	3,000	5.0	600	25.0
VI.....	21, p.m.	47	92	23, a.m.	46	78	1,400	1.5	933	38.9
VII.....	21, p.m.	32	100	24, a.m.	39	78	2,200	2.5	880	36.7
VIII.....	24, p.m.	32	100	26, p.m.	36	87	2,875	2.0	438	18.3
IX.....	24, p.m.	51	120	28, p.m.	49	86	2,500	4.0	625	26.0
Sums.....							17,225	31.0	5,315	221.5
Mean of 9 paths.....							1,914		591	24.6
Mean of 31.0 days.....									556	23.2

For graphic presentation of the movements of these highs and lows see Charts I and II.—*George E. Hunt, Chief Clerk, Forecast Division.*

RIVERS AND FLOODS.

The mean stages of the Missouri and Mississippi rivers were above those of the preceding month principally on account of the great flood in the lower Missouri and upper Mississippi